

SCIENCE

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NEW SERIES OF PORTABLE TESTING AND RESISTANCE SETS.

We print to day a description, with cuts, of a new series of portable testing and resistance sets. These sets were all designed

testing. They will be found adapted to the location of faults in telegraph and electric-light lines, determination of armature and field resistance of dynamos and motors, and the needs of government and other inspectors, as well as to general expert work.

The set shown in Fig. 1 is the most complete of the series, and



FIG. 1.

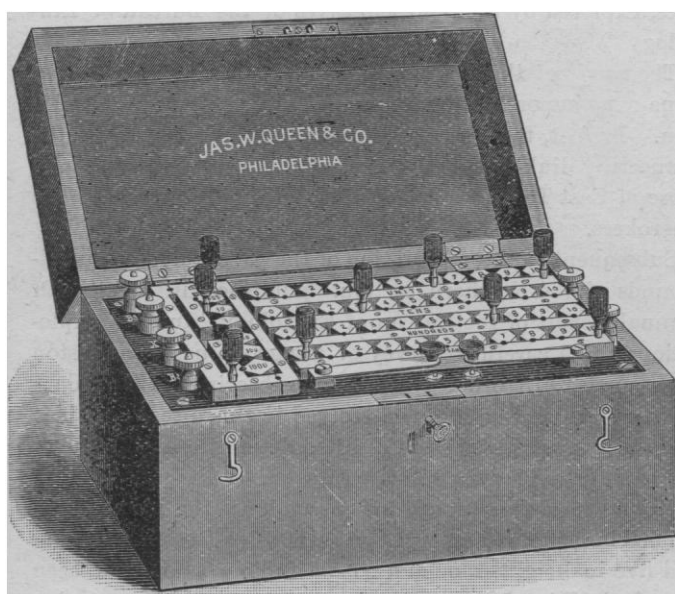


FIG. 2.



FIG. 3.

in the laboratory of Messrs. Queen & Co., Philadelphia, and are intended to meet the requirements of electric-light men, telephone line construction, dynamo and motor manufacture, and general

is intended for all kinds of work where considerable accuracy is required. The coils in this set are, as is seen from the figure, arranged in four rows, each row being made up of ten coils of the

same denomination. The blocks in each row are numbered from left to right, and from zero to ten, while the longitudinal bars underneath have engraved upon them the denomination of the coils of that row. The connections of the coils are such that but one plug is required for each denomination. By inserting it in any block, as many coils of that denomination are thrown in as may be indicated by the particular number engraved upon the block. Thus, as the cut represents it, there are in circuit 369 ohms; i.e., no thousands, three hundreds, six tens, and nine units. Another feature of this set is the arrangement of the bridge-arms, which are seen at the left. These are combined with reversing-bars, so that the proportional arms may be instantly interchanged, — an operation which is necessary in many special methods. An additional advantage is, that but six coils are necessary in the bridge, instead of eight as usual, to get the proportion of 1 to 1,000, or 1,000 to 1, thus making the set smaller and more portable. The bridge-coils are 1, 10, and 100 on one side, and 10, 100, and 1,000 on the other. To effect this reversal, two plugs only have to be changed. The coils are platinoid wire, which has a very high specific resistance, and changing by but .0023 of one per cent for each degree Centigrade of temperature variation. They are adjusted by Professor William A. Anthony to an accuracy of from one fifth to one-tenth of one per cent, while the bridge-arms themselves are adjusted to a still higher degree of accuracy. The galvanometer is a successful adaptation of a laboratory instrument to the needs of portable work, and is claimed to be the most sensitive, complete, and portable instrument ever combined in a set of this character. The wire is of several hundred ohms resistance, and is wound so as to have a maximum effect upon the needle. The needle itself is an astatic one, and delicately suspended by a very fine cocoon fibre, so that there is practically no resistance to any deflecting force. By means of a very weak controlling magnet sliding upon the suspension-tube, the needle can be made almost perfectly astatic, and will show an appreciable deflection for currents as small as from $\frac{1}{50000}$ to $\frac{1}{500000}$ of an ampère. The brass box containing needle and coil is movable about a vertical axis; so that the needle can always be brought to zero, whatever the position of the box as a whole. The whole galvanometer lifts out of its position in the case, and can be used independently, or in connection with other apparatus if desired, three levelling-screws being provided for levelling when so used. By closing the cover of the box, the weight of the needles is automatically taken from the fibre, and the latter protected from injury. The battery and galvanometer-key are seen in the front of the box, and are independent of each other. The whole is mounted up in a polished mahogany box with leather handles and lock and key, and measures when complete but 18 inches long by $6\frac{1}{4}$ inches broad. Fig. 2 is a cut of the same thing without the galvanometer, and it is of course somewhat shorter. These sets have a range of measurement from $\frac{1}{10000}$ of an ohm to 10 megohms.

Fig. 3 shows one of the other sets of the series, and is of much the same general character. The coils, instead of platinoid, are made of German silver, and are not quite so accurately adjusted, while the set is without the reversing arrangement found in the ones just described. The galvanometer also is fibre-suspended, but without the automatic release. For this purpose a small set screw is used, which allows the needle to be lowered when not in use. The galvanometer is permanently mounted in the case, and is without the control-magnet. The keys are combined into the regular double contact form. This set, as represented in the cut, has but three rows of resistance; viz., the units, tens, and hundreds. It is also made with an additional row of thousands. This set is also made without the galvanometer.

MESSRS. R. T. HILL and J. S. STONE have recently made some important explorations in southern Indian Territory, — a region about which little has hitherto been known geographically or geologically. They find that the Indian Territory is divided into distinct northern and southern divisions by the Ouachita mountain system. The southernmost of these divisions has been the special object of their studies, and they have secured most valuable data concerning it, as well as the history of the medial portion of Red River, which has not hitherto been investigated.

THE CHEROKEES IN PRE-COLUMBIAN TIMES.

III.

[In *Science* of May 30, p. 324, in the previous article on this subject, Fig. 3 is incorrect. The correct figure will be given in the revised edition of these papers when published in book form.]

SUMMING up the evidence introduced, it leads to the following conclusions:—

1. That some of the Cherokees reached their historic seat before the year 1540, probably as early as the latter part of the thirteenth century.
2. That they came from some point to the north or north-west, apparently in the region of the Ohio River.
3. That some, if not all, of the mounds of western North Carolina and East Tennessee were built by the people of this tribe.

Assuming these points to be sufficiently established, let us see what evidence can be adduced indicating their line of migration.

If their former home was in the region of the Upper Ohio, and they stopped for a while on New River and the head waters of the Holston, their line of retreat was in all likelihood up the valley of the Great Kanawha. This supposition agrees also with the fact that no traces of them are found in the ancient works of Kentucky or middle Tennessee. In truth, the works along the Ohio River from Portsmouth (except those at this point) to Cincinnati, and throughout northern Kentucky, are different from the typical works of Ohio, and most of them of a type found in no other district. On the other hand, it happens, precisely in accordance with the theory advanced, that we find in the Kanawha valley, near the city of Charleston, a very extensive group of ancient works, stretching along the banks of the stream for more than two miles, consisting of quite large as well as small mounds, circular and rectangular enclosures, etc. A careful survey of this group has been made, and a number of the tumuli, including the larger ones, explored by the representatives of the Bureau of Ethnology.

The result of these explorations has been to bring to light some very important data bearing upon the present question. In fact, the discoveries made here seem to furnish the connecting link between some of the works of Ohio and those of East Tennessee and North Carolina ascribed to the Cherokees.

Subsequent to the preparation of the paper on the "Burial-Mounds of the Northern section," published in the "Fifth Annual Report of the Bureau of Ethnology," further explorations and a careful resurvey of the group near Charleston were made. In order to show the bearing of the data obtained on the questions involved in this discussion, it is necessary to give somewhat detailed descriptions of some of the mounds explored.

Mound 15 of this group (for convenience the numbers in the original sketch are used) was sixty-five feet in diameter and five in height, though a considerable portion had been ploughed off in cultivating the soil. In the top was a basin-shaped fire-bed somewhat oval in outline, being about seven feet long and four feet wide. This was composed of a mixture of clay and ashes burned to a brick red on the upper side; but the under side had a black, greasy appear-

ance. Below this was a similar bed, on and about which were numerous small fragments of bones, but too much broken and charred to show whether they were human or animal.

These basin-shaped beds remind us of those of similar form found in the mounds of East Tennessee, and present one indication of relationship between the mound-builders of the two sections.

Mound No. 18, about the same size as the preceding, contained a similar series of basin-shaped fire-beds, lying one below the other in the central portion. Below them, near the bottom of the mound, was a considerable bed of charcoal and ashes; and immediately under this, on the original surface of the ground, the fragments of a skeleton, with which were a number of broken arrow and spear heads.

Mound No. 1 of the group is of large size, measuring five hundred and twenty feet in circumference and thirty-three in height. This was explored by sinking a shaft twelve feet square to the bottom. At the depth of from three to four feet, in a bed of mixed clay and ashes, were three skeletons lying extended on their backs, doubtless intrusive burials. From this point downwards for twenty feet, nearly all of the material in the shaft consisted of the same mixed substances, so hard as to require the constant use of the pick. At the depth of twenty-four feet there was a sudden change to a much softer and darker-colored earth, in which were the casts and decayed fragments of poles and logs from six to twelve inches in diameter. These, together with fragments of bark, ashes, and animal bones which had been split lengthwise, continued through a layer of about six feet. At the depth of thirty-one feet a human skeleton was discovered lying prostrate, head north, the skull crushed but partly preserved by contact with a sheet of copper (only fragments of which remained) that probably once formed part of a head-dress of some kind. By enlarging and curbing, the shaft was extended to a diameter of sixteen feet. It was then found that a layer of elm-bark had been carefully spread, with the inner side up, upon the smoothed and well-packed surface of the ground. This had been covered with a layer a few inches thick of fine white ashes. On this the body was laid, and covered with similar bark.

Ten other skeletons, all buried in the same manner, were found at this point, arranged, five on each side, in a semi-circle around the central one just mentioned, with feet turned toward it. With each skeleton on the east side of the centre was a fine, apparently unused lance-head; and by the side of the northern one of these five, a fish-dart, three arrow-points, and some decayed mussel-shells. Nothing was found with the other five. With the central one, in addition to what has been mentioned, were six shell beads and a large lance-head.

But what interests us more at present is the fact that near the head of the latter was a conical vault of very hard clay, about four feet high and five feet in diameter. This was partially filled with rotten bark, human bones, and dark, decomposed matter. Immediately under this, but covered with clay, were two circular holes about sixteen inches in diameter, and four feet deep. A similar pair of holes was found at the head of each of the ten surrounding skeletons, ranging in depth from two to three feet, and in diameter from eight to twelve inches.

The little beehive vault, resembling so exactly in form and size those of North Carolina, although built of clay, is another indication of relationship between the mound-builders of the two sections. On the other hand, the burial between the layers of bark is precisely what is often found to be the case in the Ohio mounds, as appears from the following statements by Messrs. Squier and Davis in "Ancient Monuments:" "The course of preparation for the burial seemed to have been as follows: the surface of the ground was first carefully levelled, and packed over an area perhaps ten or fifteen feet square. This area was then covered with sheets of bark, on which, in the centre, the body of the dead was deposited, with a few articles of stone at its side, and a few small ornaments near the head. It was then covered over with another layer of bark, and the mound heaped above."

The individual or skeleton buried in the conical vault had probably been wrapped in bark.

That there was a wooden structure of some kind covering the area occupied by the skeletons is more than probable, as thus only can we account for the timbers. The holes mentioned may indicate the position of a former structure, but this had been removed before the burials took place. It would seem that most, if not all, of the burials took place at one time, and after the flesh had been removed.

Mound 21, known locally as the "Great Smith Mound," is the largest of the group, being a regular cone, thirty-five feet high, and one hundred and seventy-five feet in diameter at the base. This was explored by sinking a shaft to the bottom twelve feet in diameter. It is a double mound, or mound of two stages. The first building carried it to the height of twenty feet: after a considerable time had elapsed, another stage of work carried it to its present height. Near the top were some skeletons, probably intrusive burials. At the depth of twelve feet the explorers began to find the fragments and casts of logs, the first being that of a black-walnut log, which must have been nearly twelve inches in diameter and several feet in length. Further excavation made it apparent that these timbers were the remains of a wooden vault about thirteen feet long and twelve feet wide. From all the indications,—the casts of the posts and logs, the bark and clay lining, the fallen timbers, the bark of the roof, etc.,—it was inferred that the vault was constructed as follows: after the mound, which was at this time twenty feet high, had been standing for an indefinite length of time, a square pit, twelve by thirteen feet, was dug in the top to the depth of six feet; posts were then placed along the sides and ends, the former reaching only to the surface, but the central ones at the ends rising four feet higher; on the latter was placed the ridge-pole (the walnut log first encountered); the sides were plastered with a mixture of clay and ashes, and possibly lined with bark; the roof, which had fallen in, was made of poles, and covered with bark; over all was heaped the superincumbent mound fifteen feet in height.

In this vault were five skeletons, one lying prostrate on the floor at the centre. The other four had been placed, one in each corner, apparently in an upright position. All had been wrapped in bark. The central skeleton was very large, measuring a little over seven feet in length. Each wrist was encircled by six heavy copper bracelets. A fragment of the wrapping, preserved by contact with the copper, shows that it was black-walnut bark. A piece of dressed skin,

which had probably formed the inner wrapping, was also preserved by the copper. Upon the breast was a copper gorget; by each hand were three flint lance-heads; near the right hand, a small hematite celt and a stone axe. Around the head, neck, and hips were about one hundred small, perforated sea-shells and some shell beads. Upon the left shoulder, lying one upon another, were three sheets of mica from eight to ten inches long, six to seven in width, and half an inch thick.

Further discoveries of badly decayed skeletons were made in carrying the shaft downward below the vault, but nothing with which we are at present concerned except the fact that among the articles obtained was the steatite pipe shown in Fig. 8.

The significance of this mound lies in the close resemblance it bears, in some respects, to the Grave Creek mound, which, according to the tradition of the Cherokees, was built by their ancestors. But at present no argument is based upon this part of the tradition. This latter giant tumulus is in the form of a regular cone, seventy feet high, and nearly three hundred in diameter at the base. A shaft sunk from

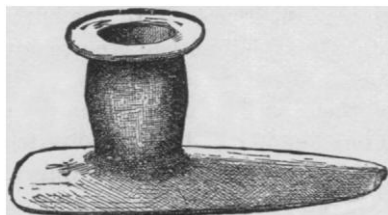


FIG. 8.

the apex to the base disclosed two wooden vaults,—the first about half way down, and the other at the bottom. In the first or upper one was a single skeleton decorated with a profusion of shell beads, copper bracelets, and plates of mica. The lower vault, which was partly in an excavation made in the natural ground, was rectangular, twelve by eight feet, and seven feet high. Placed close together along each side and across the ends of the excavation were upright timbers or posts, which supported others thrown across to form the roof. In this vault were two human skeletons, one of which had no ornaments, while the other was surrounded with hundreds of shell beads. In attempting to enlarge this vault, the workmen discovered around it ten other skeletons.

The similarity in the method of constructing the vaults is marked and peculiar. Wooden vaults are not uncommon; but those partially sunk in a pit, with the sides and ends formed of upright posts, are very rare, and are probably due to some peculiar custom, and indicate tribal identity of the builders. We notice also the presence, with one of the skeletons in each mound, of copper bracelets and plates of mica. In both a vault is built about midway the height.

Mound 31 of the Kanawha group presents some striking resemblances to the so-called sacrificial mounds of Ohio. It is somewhat flattened on top, three hundred and eighteen feet in circumference at the base, and twenty-five feet high. After passing through the top layer of soil, some two feet thick, a layer of clay and ashes one foot thick was encountered. Here, near the centre of the shaft, were two skeletons lying horizontally. These were probably intrusive

burials. At the depth of thirteen feet, and a little north of the centre of the mound, were two large skeletons in a sitting posture, with their extended legs interlocked to the knees. Their arms were extended and their hands slightly elevated, as if they were together holding up a sandstone mortar which was between their faces. At the depth of twenty-five feet, and resting on the natural surface of the ground, was one of the so-called "altars," precisely similar to those found in some of the Ohio mounds. This, which was thoroughly traced, was found to be twelve feet long and a little over eight feet wide. It consisted of clay, apparently slightly mixed with ashes, the middle portion basin-shaped, and the margins sloping downwards and outwards; in other words, it was a typical "altar," similar to that shown in Fig. 32, "Ancient Monuments." The depth of the basin in the centre was a little over a foot, and the thickness of the bottom at this point about six inches. On this rested a compact layer of very fine white ashes from one to two feet thick, entirely covering this clay bed. Scattered through them were many water-worn boulders from three to five inches in diameter, all bearing indications of exposure to intense heat; also fragments of charred bones, some of which were nearly destroyed by heat. The upper side of this clay bed or "altar" was burned to a brick red.

That this tumulus must be classed with the (so-called) "sacrificial mounds" of Ohio, will, it is presumed, be admitted without any objection. As the custom of building these clay structures, to which Messrs. Squier and Davis applied the name "altars," seems to have been peculiar to one class of Ohio mound-builders, we have here one very strong indication that the people who built the mounds of this Kanawha group belonged to the same tribe.

Mound 23 is of considerable size, measuring three hundred and twelve feet in circumference and twenty-five in height. It had never been disturbed in any way, and was the most pointed and symmetrical of the group.

As the discoveries made in it are important in this connection, the report of the Bureau explorer is given somewhat fully.

It was examined by sinking a large central shaft to the bottom. From the top to the depth of fifteen feet, the material passed through was an exceedingly hard, gray mixture, apparently of ashes and clay. At this depth casts of poles and timbers of various sizes were discovered, but all less than a foot in diameter, extending into the western and southern sides of the shaft. These casts and rotten wood and bark continued to increase in amount nearly to the natural soil, which was reached at the depth of twenty-five feet. The *débris* being removed, and the bottom of the shaft enlarged to fourteen feet in diameter, it was ascertained that these timbers had formed a square or polygonal vault, twelve feet across, and some eight or ten feet high in the centre. This had been built up in the form of a pen, the ends of the poles extending beyond the corners. The roof must have been sloping, as the ends of the poles used in making it extended downward beyond the walls on which they rested. On the floor of this vault, which corresponded with the original surface of the ground, were two adult skeletons, the bones of which, though but little decayed, were crushed and pressed out of position. No implement or ornament was found with them.

As the earth of this floor did not appear to be the natural soil, the shaft was carried down four feet farther. This revealed a pit, the lateral extent of which could not be determined, but which had been dug to the depth of four feet in the original soil. On the floor of this pit, at one side, arranged in a semicircle, were six small clay vaults in the shape of beehives, about three feet in diameter at the bottom, and the same in height.

They were made of clay and ashes mixed, very hard, and impervious to water. Possibly they had been allowed to dry before being covered with earth. They were partially filled with a dark, dry dust, apparently of some decayed substance. A few fragments of bones were found in them.

In the centre of the space around which these little vaults were arranged, but only two feet below the floor of the large wooden vault, were two small clay-lined cavities about the size and form of the ordinary water-jars from the Arkansas mounds. Possibly they were decayed, unburnt vessels which had been deposited here at the time of burial.

The bottom of the pit, which consisted of the natural deposit of yellow sand, was covered with a layer of charcoal and ashes two or three inches thick. This sand appeared to have been heated, from which it is inferred that the burning took place in the pit previous to the formation of the vaults.

The work was suspended at this stage, on account of extreme cold weather, but was recommenced the following season by running trenches from the sides into the shaft, and afterward carrying a tunnel in at the base. In one of these trenches, nine feet from the top, occurred a layer of soft earth, in which were numerous fragments of decayed timbers and bark, also casts of logs extending horizontally into the sides of the trench. These, it is presumed from what was afterward discovered, pertained to a wooden burial-vault. The tunnel carried in at the base was from the south side, ten feet wide, and eight feet high. For a distance of twenty feet it passed through the hard gray material of which the body of the mound was composed. Here the explorers suddenly encountered a deposit of soft earth in lenticular masses and of various colors, showing that it had been brought from the hillsides and bottoms near by. A short distance from this point they began to find the casts and remains of the timbers of the large central vault, but, before reaching the interior, passed over a small refuse-heap, evidently belonging to an age preceding the date of the building of the mound. As they entered the remains of the vault, they began to find tolerably well preserved human bones, but no whole skeletons. Seeing here indications of the pit before mentioned, the tunnel was carried downward four feet, disclosing five little clay vaults similar to those found on the other side, and, like them, placed in a semicircle. It was now decided to remove and thoroughly explore about one-half of the mound. Many stone implements, some entire but most of them broken, seemingly by the action of fire, were scattered through the hard upper layer; also numerous single valves of mussels which had been used as digging-tools until they were worn from the outside entirely through.

There was a marked dissimilarity between the northern and southern sides of this mound, the former being a compact mass of variously colored soils from different points in the vicinity, in alternate horizontal layers. The separate

loads of the individuals who carried this earth were plainly defined; and the different sizes of these small masses indicate that many persons, some much stronger than others, were simultaneously engaged in the work.

With the exception of the imperfect or broken specimens mentioned above, no remains of any kind were found in that portion of the mound above the fire-bed and north of the central shaft, and only two skeletons beneath it; while many interesting finds of implements were made all through the loose, ashy dirt of the southern part, and many skeletons below it. The amount of rotten wood and bark observed, and the positions of the casts of logs and poles, some of which extended downward four feet below the natural surface of the ground, render it probable that there was a wooden structure here twelve feet square and three stories high, or, what is more likely, three structures, one above another.

A foot above the natural surface, or twenty-four feet from the top of the mound, was a smooth horizontal layer of sand and ashes, interrupted by two heavy fire-beds. These beds were circular in form, eight feet in diameter, and about ten feet apart. The earth was burned hard for eight inches below the ashes. Under these beds were several human skeletons.

No. 1, a medium-sized adult, was extended on the back, head south, arms by the side. This was four feet below the centre of the northern fire-bed. No trace of a coffin was observed, but a rude hoe and a rough lance-head were at the left side.

No. 2 was four feet north of No. 1, at the same depth. It lay with the feet toward the centre of the mound, and was enclosed in a kind of coffin formed by leaning flat stones together over the body in the form of an inverted V, and placing a similar stone against the end at the head. A number of relics were with this skeleton, and on the stone at the head was a hematite celt. Two feet north of the head were the fragments of a large clay vessel.

No. 3, similarly placed, was four feet under the north edge of the other fire-bed. Some relics were found above the head, and others in a small conical vault near the left side.

No. 4, same depth as the preceding, had the head toward the centre of the mound. A small vault near the head contained several relics of different sorts.

Nos. 5 and 6 lay near together, with heads south. There was a small vault near the feet of the smaller skeleton.

None of these skeletons were found immediately in the centre of the mound, and all were about four feet below the natural surface of the ground, resting on the bottom of the pit, as were the little conical vaults. Nine vaults in addition to those mentioned were unearthened,—four of them on the bottom of the pit, and five above it. They were similar in form and size to those heretofore described. There was one toward the south side of the pit elongate in form, and not more than two feet wide and two feet high.

Another mound, numbered 30 in the original plat, had a circular pit beneath it, in which were several beehive-shaped clay vaults similar to those heretofore mentioned. The explorer, however, in this case, fails to mention the arrangement or to note particularly the contents, owing perhaps to the pit being partially filled with water, which prevented a thorough examination.

By a careful comparison of the discoveries made in the mounds of this Kanawha group with those made in the mounds of the Cherokee section, the reader will observe some striking similarities which cannot be easily accounted for upon any other theory than that of tribal identity or intimate relations of the peoples of the two sections. It is true that we find enclosures in the former locality, and none in the latter, and it is also true that we notice other dissimilarities; but some changes in customs and works are to be expected where there is a change of location. Necessities, materials, and environments are different, and bring about modifications of customs. These changes are apparent in all parts of the mound area, even where there are good reasons for attributing the works to the same people: in fact, they are sometimes found in a single group.

It is true, we cannot assert positively that the little conical clay vaults above described, except in one or two cases, were depositories of the dead, as were the conical boulder vaults of North Carolina and East Tennessee; yet the very marked similarity in form and size, and correspondence in their arrangement in the tumuli, justify the belief that there was a relationship between the authors of the works of the two sections. Not only are they similar in size and form, but in both localities pits were dug in the original soil, the floor was covered with coals or ashes in some cases, and the vaults built on these and the mound heaped over them. It should also be borne in mind that vaults of this kind, arranged as here stated, have so far been found only in these two sections. The arrangement in a circle found in the mound in Sullivan County, Tenn., has its parallel in one of the mounds of the Kanawha group. In one was also found the pipe shown in Fig. 8; in the other, that shown in Fig. 5.

In further corroboration of the theory of relationship between the people of the two sections, may be mentioned the fact that in the mounds of both we find the peculiar basin-shaped beds placed in series one above another.

CYRUS THOMAS.

[To be continued.]

NOTES AND NEWS.

LIEUT. J. P. FINLEY, of the United States Signal Corps, has gone to San Francisco to take charge of the Pacific Coast Weather Service.

—Professor John C. Branner, State geologist of Arkansas, delivered a course of lectures on geology to the senior and junior classes at the Rose Polytechnic Institute, Terre Haute, Ind., week before last.

—Dr. William K. Newton of Paterson has resigned as dairy and food commissioner of New Jersey. This was done two months since to the State Board of Health, which, on the 6th of May, appointed one of Dr. Newton's assistants, Mr. George W. McGuire of Trenton, to fill the vacancy.

—We learn from *Nature* that Professor Von Nordenskiöld lately announced to the Stockholm Academy of Sciences that a scientific expedition would start during the summer for Spitzbergen. Among the party will be his son, M. G. Nordenskiöld, and MM. Klinckowström and Bahaman. The expenses of the expedition will be defrayed by Baron Dickson and M. F. Beijer, the publisher.

—A statistical investigation of lightning-strokes in central Germany, covering a period of twenty-six years, has been carried out by Herr Kastner. According to *Nature*, the number of cases has increased about 129 per cent, and last year (1889) it amounted to 1,145. The author distinguishes four thunder-storm paths.

The starting-points of all these are in hills, and in their course the woodless districts and flat country, the river-valleys, and low meadow-ground about lakes, seem specially liable, while the wooded and hilly parts generally escape. The hottest months (June, and especially July), and the hottest hours of the day, or those immediately following them (3 to 4 P.M.), show the most lightning-strokes.

—We learn from *Humboldt* that in connection with the tenth international medical congress, to be held this year in Berlin from Aug. 4 to Aug. 9, there is to be an international medico-scientific exhibition. The following kinds of objects will be exhibited: new or improved scientific instruments and apparatus for biological and especially medical purposes, including apparatus for photography and spectrum analysis so far as they are of service to medicine; new pharmaceutical and chemical stuffs and preparations; new or improved instruments for operative purposes of medicine, including electrotherapy; new plans and models of hospitals, convalescent homes, disinfection arrangements, baths, etc.; new arrangements for care of the sick, including means of transport, and baths for invalids; newest apparatus for hygienic purposes, etc. Communications (marked "Ausstellungsangelegenheit") should be sent to the office of the congress, Dr. Lassar, Berlin, N.W., Karlstrasse 19.

—The daily and yearly variation, and the distribution, of wind-velocities in the Russian Empire have been fully investigated by Kiersnowski, says *Nature*. The highest velocities (mean 6.3 metres per second) occur in the Baltic provinces. On the White Sea, on the Caspian, in the region of the North Russian lakes, and on the Steppe, the values are also high; in the forest region and the Caucasus they are low. Towards the interior of Asia the velocity decreases, and in Transbaikalia is the minimum (1.5 metres per second). Farther east, towards the Pacific, the velocity increases. In the annual period, the maximum is pretty uniformly in winter, the minimum in summer. A maximum in spring, and a minimum in summer or autumn, are peculiar to the Caspian region, the Ural, and West Siberia, with Central Asia. In eastern Siberia the minimum is in winter. The daily variation shows distinctly the connection with cloudiness. The greatest amplitude occurs in the brighter part of the year: in East Siberia in winter, and in the rest of the country in summer. In general, the amplitude increases regularly with the clearness of the sky eastward, and on land it is greater than on the sea.

—In seven years, experiments at the Ohio Agricultural Station with deep and shallow planting of corn show an advantage in favor of planting one inch rather than two inches deep, but indicate that in dry seasons it may be better to plant two inches deep. The greatest amount of marketable corn has been produced where the stalks averaged twelve inches apart. The variations in yield were slight, whether planted one grain every twelve inches, two every twenty-four, three every thirty-six, or four every forty-eight inches. Three years' trial has not indicated any marked differences in the reproductive qualities of corn from the butts, middles, or tips of the ears. If there is any variation, it is in favor of middles and tips, and against the butts. The experiments of 1888 and 1889 indicate that corn should be cultivated more frequently in a dry season than in a wet or ordinary one. The average results of two years' experiments favor deep cultivation rather than shallow. The implements used were the harrow and cultivator for shallow tillage, and the double shovel for deep. This work was under the care of J. Fremont Hickman.

—The papers read at the May meeting of the Royal Society of Canada included, in the section on mathematical, physical, and chemical sciences, "The Unit Measure of Time," by Dr. Sandford Fleming, president of the section; "Tidal Observations in Canadian Waters, the Present Condition of the Question," by Professor A. Johnson, McGill University, Montreal; "Sunspots observed at McGill College since June 1, 1888," by Professor C. H. McLeod of McGill University; "Notes on Cream-of-Tartar Analysis," and "Notes on Baking-Powder Analysis," by A. McGill; "Milk Analysis by the Asbestos Method," by Frank T. Shutt; "On a Peculiar Form of Metallic Iron found in Huronian Quartzite on the North Shore of St. Joseph Island, Lake Huron, Ontario," by G. Chr.

Hoffmann; "Drift Rocks of Central Ontario," by Professor A. P. Coleman of Victoria University; and "On the Density of Weak Aqueous Solutions of Certain Sulphates," and "On a Test of Ewing and MacGregor's Method of Measuring the Electrical Resistance of Electrolytes," by Professor J. G. MacGregor. Those in the section on geological and biological sciences included the presidential address, "Mesozoic and Tertiary History of the Rocky Mountain Region of Canada," and "Glacial History of the Rocky Mountain Region in Canada," by George M. Dawson; "Foraminifera and other Minute Organisms from the Cretaceous of Manitoba," by J. B. Tyrrell; "On Fossil Plants from the Similkameen River and other Places in the Southern Interior of British Columbia," by Sir William Dawson; "Descriptions of Some New or Previously Unrecorded Species of Brachiopoda and Mollusca from the Devonian Rocks of Manitoba," and "The Marine Invertebrata of the River and Gulf of the St. Lawrence," by J. F. Whiteaves; "Notes Stratigraphiques sur le Rocher de Québec," par l'Abbé Laffamme; "Illustrations of the Fauna of the St. John Group, No. V.," by G. F. Matthew; "The Evidence of a Nova Scotia Carboniferous Conglomerate," by E. Gilpin; and "Southern Invertebrates on the Shores of Acadia," by W. F. Ganong.

—The fourth international congress on inland navigation will be held in Manchester, England, on July 28 and following days. The objects of the congress are, to promote the improvement of inland navigation and of estuaries; to direct attention to the economical value of navigable water-ways; to examine, generally, technical questions relating to the construction and working of canals; to receive the report of the International Statistical Commission appointed at the last congress; and to take further steps towards the collection of statistics bearing on inland navigation. The three previous congresses were held respectively in Brussels, Vienna, and Frankfort-on-the-Main. It is intended to have an exhibition of plans, maps, and models relating to inland navigation. At the Frankfort congress a similar exhibition was held, the most valuable contributions coming from the German Government, who spent \$20,000 on their preparation. It is hoped that these plans and models may be available for re-exhibition in Manchester. All communications relating to the congress should be addressed to the secretary, at Lombard Chambers, 46 Brown Street, Manchester, England.

—According to a work recently published by one of the state foresters of Prussia, the entire forest area of Germany now amounts to 14,000,000 hectares (34,596,000 acres). Russia has 200,000,000 hectares (494,228,620 acres) of forests; Austria-Hungary, 19,000,000 hectares (46,952,000 acres); Sweden, 17,000,000 hectares (42,010,000 acres); France, 9,000,000 hectares (22,241,000 acres); Spain, 8,000,000 hectares (19,769,000 acres); Italy, 4,000,000 hectares (9,884,572 acres); and England, 2,471,000 acres. The United States commercial agent at Mayence says that the proportion of communal to state and crown forests in the different states of Germany is as follows: Prussia, 1,355,000 hectares of communal and 2,423,000 state forests; Bavaria, 388,000 and 941,000 respectively; Wurtemberg, 190,000 and 192,000; Hesse, 90,000 and 67,000; Baden, 259,000 and 93,000; and Alsace-Lorraine, 195,000 and 151,000 hectares. In Saxony and in the other states of the empire, with the exception of Saxe-Meiningen, about one-half of all the forests are state or communal property, considering the possessions of the crown as a species of state property; and these are all subject to a well-regulated permanent administration and supervision under state control, while the older forests in many of the states are not under any public control. It is stated, in the work referred to above, that there are 9,100,000 hectares (22,487,400 acres) of coniferous, and 4,800,000 hectares (11,800,000 acres) of foliaceous, trees in Germany. Of the coniferous trees, it is stated that a greater part are on a soil adapted only to such growth, and on which nothing else can be cultivated. Of the coniferous trees, 3,000,000 hectares (7,413,000 acres) are of the fir kind, and 6,000,000 hectares (14,826,800 acres) pines. The greater part of the pines are in the mountains, preponderating in the Hartz Mountains, the Riesengebirge, the Erzgebirge, in the Thuringian forests, in the Verm, in the Vosges Mountains, in the Black Forest, in the so-called Bavarian Alps, in the Bavarian

Forest, and in the Franconian, Jura, and Fichtel Mountains. The pines are mostly on level tracts, and more than half of them are on soil unfit for the successful cultivation of useful timber. The 4,800,000 hectares of foliaceous trees are principally made up of beeches.

—Dr. Max Buchner, who has spent a year and nine months in Australia, Japan, China, and Manila, has returned to Munich, Germany. He carried back a valuable scientific collection for the Ethnographical Museum, of which he is the director.

—An annual prize of fifty dollars, for a period of three years, has been offered by a member of the Baltimore bar to that member of the Johns Hopkins University who shall make the best contribution to institutional or legal history. The field is not restricted to American or English laws and institutions, but is extended to the history of early society. Papers should be handed to Dr. Herbert B. Adams before Feb. 1, 1891.

—The Draper medal was awarded to Professor H. A. Rowland by the National Academy of Sciences at its April meeting in Washington. The medal is given every two years for original investigations in the department of astronomical physics. Professor Rowland was awarded the medal for his work in spectrum analysis, the perfecting of diffraction gratings for producing spectra, and his investigations of the solar spectrum.

—In connection with the report of the United States Eclipse Expedition to West Africa, under the direction of Professor D. P. Todd, a work of very great importance to navigators is to be undertaken; namely, the preparation of a set of daily weather-maps of both oceans from October to May inclusive, the entire period of the cruise of the United States Steamship "Pensacola." The United States Hydrographic Office calls attention to the importance of this subject, and the exceptional opportunity that is presented for utilizing the data already at hand, together with such additional data as may be contributed for this purpose by various government offices and individual navigators. The scheme determined upon consists in the preparation of a weather-map for each day at noon, Greenwich mean time, from Oct. 1, 1889, to May 31, 1890, inclusive, for the entire area between latitude 70° north and 60° south, longitude 20° east and 100° west. In addition to the Greenwich noon observations that are kept regularly for the Hydrographic Office by nearly two thousand voluntary observers, it is earnestly desired that other navigators of these waters, within the limits of time and place mentioned above, forward to that office such data from their log-books as may be useful in this connection, selecting those observations that come nearest to noon, Greenwich mean time, and stating as many details as possible regarding wind, weather, state of the sea, and velocity and set of currents. Data from land stations are also very important, especially such as are not accessible in any published records. To make this great undertaking a success, however, there must be further and cordial co-operation among the nations interested in the meteorology of this vast area, and among navigators of every nationality. It has long been the desire of the Hydrographic Office to commence the publication of a pilot chart of the South Atlantic and west coast of South America, and the present undertaking will furnish an admirable basis for this work. The "Pilot Chart of the North Atlantic Ocean" has won a place for itself in the esteem of navigators generally, without regard to nationality, and it is intended to publish the result of the present investigation in such form, and with such wide distribution, as well to repay every one who contributes to its success. Reports handed to any United States consul, or to the commanding officer of any United States naval vessel, will be transmitted free of all expense to the observer, and in each case due credit will be given in the published report.

—A new catalogue of electrical testing apparatus has just been issued by James W. Queen & Co., Philadelphia. This catalogue is believed to be the most complete in its special field of any yet published in this country. We shall call attention in this and early issues to their new resistance-boxes, portable testing-pieces, and photometers for use in electric-light comparisons. The catalogue will be sent by the firm to any interested.

SCIENCE:

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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CORNELL AND THE LOST WILL.

THE newspapers are publishing the customary type of absurd stories about the history and loss of the great bequest of Mrs Jennie McGraw Fiske, which has just been lost to Cornell University through the operation of a technicality in law, and the active exertions of her surviving husband and of the next of kin, who brought suit to secure what they, and all the world, knew that they were not given by the deceased owner of the property. The true history of the case in brief, as we obtain it from a reliable source, is the following:—

John McGraw was, at the time of his death, an old lumberman who had made an enormous fortune in the North-west, working in company with Henry W. Sage, Hiram Sibley, and a few other equally successful comrades and friends. He was a friend and fellow trustee with Ezra Cornell at the founding of Cornell University, and took great interest in that now great institution of learning. He contributed largely to its treasury and needs, in its early days, and finally died with fortune unimpaired, leaving it mainly to his only child, Jennie. Miss McGraw had grown up in the midst of the little circle of wealthy and liberal men who did so much to make the university what it is, and from them (for she was intimate with all) had received her inspiration. When her father built what is now known as McGraw Hall, the largest building of the dozen scattered over the great campus, the child asked the privilege of contributing the beautiful chime of bells which now hangs in its tower, and calls the students to their daily tasks.

This interest she never lost: it increased, rather than decreased with time.

Miss McGraw, a few years before her death, lost her health, and remained in a critical condition to the end. Meantime she had made the acquaintance of the librarian of the university, Professor Fiske, and after a time, becoming interested in each other, they were married, and the professor took his bride to Europe in the vain hope that her health might be restored. She failed steadily, and finally returned with her husband to her home on the university campus, to die. Her death took place within a few days of their return.

Meantime, under her directions, a large and beautiful house had been built on a commanding site between the university and the bank of Cayuga Lake, which was never occupied; the couple living, in the interval, in a modest little cottage, still standing within the university grounds. A pre-nuptial contract had been entered into between the affianced pair, by which Mrs. Fiske was permitted to dispose of her millions as she might choose, and which provided properly for her husband in case of her death. At her death it was found that a will had also been made, giving liberally to the natural heirs, and leaving her husband \$300,000 and personal property. The university was given \$40,000 to found a hospital; and the residue of the estate, now amounting to nearly two millions of dollars, after paying legacies, was to be devoted to the building and endowment of a library for the university. All legacies were promptly paid by the executor, and the balance of the estate was in process of conversion into the university treasury, when suit was brought by the husband to break the will,—a suit in which he was presently joined by the heirs, to whom, as well as to the husband, liberal legacies had been paid.

It appeared that a clause existed in the charter of the university, limiting its holdings of property to a gross amount of \$3,000,000. This had been inserted in the document at the first, and had never been removed, although it must have been known that the holdings were approaching perilously near this limit. The plaintiffs in the case asserted that the university already possessed so nearly this amount—above \$2,000,000, as they stated—that it was legally debarred from accepting the gift of Mrs. Fiske; and the property must therefore go to the next of kin. The trustees and the executor of the will, as defendants, asserted that this was not the fact, the property inventoried including large amounts held in trust for the State, and not the property of the university, though its income was pledged to the university for educational purposes. Other and technical defences were raised by the defendants. No one, on either side, claimed or admitted that there was any question of the intent of the testatrix; no one disputed the fact that she had desired and intended to give her property to the university, and that no one else had the slightest moral right to it. The question was simply and solely whether a technical interpretation of the laws affecting the holding of property could be made to give to others what they had no moral claim upon, and to take from the university, and to deflect from its great purpose, a gift of enormous value and potential usefulness, which was morally the absolute property of the institution, and pledged to the specified purpose.

The Surrogate's Court decided in favor of the university: the higher courts of the State, and the Supreme Court of the United States, reversed the finding, and gave the property to the claimants. They now hold it, though every one gaining by the transaction is fully aware that the deceased, if conscious of what is going on here below, must feel that her intent has been defeated; that they have no real right to her property; that the intent must always stand a moral bar to their receiving the money for any other purpose than to carry into effect her intention, defeated as it is, for the moment at least, by the operation of an unexpected legal impediment.

The amount involved approaches \$2,000,000; but legal expenses, and losses in realizing on the property, may bring the net sum below a million and a half. Had this great fund gone into the hands of the trustees of the university, it would have founded perhaps the noblest library on the American continent. As it is, it may be seriously questioned whether it is likely to do much good, even to the legal but yet false inheritors. The daily papers

are full of sensational stories relating to the personal relations of the testatrix, her husband, and the responsible officers of the university; the one side attempting to justify the action of the will-breakers by asserting injustice on the opposite side, the other side defending the action of the university authorities. The public are not concerned in that phase of the matter, and the university authorities evidently feel themselves unaffected by the gossip of the newspapers. Mr. Sage, a year ago, began the erection of a great library building to be given the university as a memorial of the originally intending giver if the suit should be lost, or to be paid for by her bequest should the university hold its own in the case. He gives also \$300,000 as an endowment, the income to be applied solely to the purchase of books. Most colleges would be considered fortunate if given so much, even failing to obtain a \$2,000,000 library. Practically the university gains: it loses a million which it never possessed; but it gains a positive quantity in the half million and over, which is now actually passing into its possession. It is the impression of some of its best-informed friends that it will ultimately actually gain through awakened sympathy and interest, and the gifts likely to be the practical expression of that interest and sympathy, more than the amount now seemingly so unfortunately lost. It is very certain, also, that some of this scattered property will come directly back to the university by the action of the receivers of what they regard as unfairly acquired property.

This affair seems to have no effect on the plans of the university authorities. They will begin the next year with an enlarged teaching force, new and distinguished professors in the faculty, a \$10,000 equipment in illustrations of the work of classical instruction, a new chemical laboratory to accommodate six hundred, a physical laboratory of double the space now occupied, new workshops doubling the present area and capable of handling six hundred Sibley College men, new mechanical laboratory arrangements of nearly proportional extent, a new foundry and new forge large enough to meet a similar growth, and engines (experimental and other), boilers of 600 horse-power, and dynamos more numerous and powerful in the aggregate than can be found elsewhere in the world.

All this looks very much as if Cornell University and the Sibley College of Mechanical and Electrical Engineering were likely to survive for a time still.

HEALTH MATTERS.

Another Forty Days' Fast.

SIGNOR SUCCI, who is gaining the reputation of being a "hunger virtuoso," completed in May a fast of forty days in London. The medical journals of that city credit him with the genuine performance of the feat. Signor Succi has done no more than our own Tanner, but he has been subjected to a more careful physiological study, and he has shown that a forty-days' fast is possible to more than one human being. During the last days of his fast, Succi lost about half a pound a day, his temperature remained normal, but his pulse was more than ordinarily rapid. The lesson of Signor Succi's experiment, says the *Medical Record*, is one that has often been taught before, and it is that people eat too much, and, in this country at least, drink too little. More diseases come from excessive and intemperate feeding than from alcohol, for wrong feeding is the basis of gouty, rheumatic, diabetic, and obese diatheses; as well as of an infinite number of gastrointestinal ills.

Excision of Local Pulmonary Tuberculosis.

At the recent congress of the German Society for Surgery, Professor Tillmanns exhibited a man of about thirty years, from whom he had removed a tubercular deposit involving a portion of the left lung, pleura, and thorax. After the operation the lung contracted in such a manner that by a second operation the remaining tubercular area was completely removed. The wound was covered with cutaneous flaps and healed completely, and the patient is now able to work. As the operation was performed about two years ago, the cure may be regarded as permanent.

Tillmanns thinks that the surgical treatment of pulmonary tuberculosis is proper if the disease is localized, but that in most cases two operations will be required,—the first to expose the affected part in order to bring about atrophy and contraction; the second to remove the disease.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Practical Applications of Meteorology.

IN the United States the making of weather predictions has been the chief use of meteorological observations for so long a time, that few persons have taken the trouble to consider the manifold applications of this class of data. In order to bring this matter to the notice of those who are interested in, but not informed on, this practically very important question, I have given below, in a roughly systematic manner, some few of the many points which should be taken into consideration in the framing of any future plans for extending the usefulness of meteorology in our country. In order to show with any considerable degree of fulness the exact relation of meteorology to practical life, it would be necessary to devote the space allowed for a magazine article to each one of the separate headings which I have assumed as conveniently and appropriately marking the subdivisions of the whole subject; so that, in the present paper, only a few lines can be devoted to each topic. This is mentioned in order to explain the omission of many points which could be readily suggested as being of equal importance with those mentioned.

1. AGRICULTURE.—We have but to note the gradual change in the character of plant-life with the increase of latitude or altitude, in order to see what an all-important factor climate is, in marking the limits of individual plant-growth. Some plants require a preponderance of heat, others of moisture, and still others of sunlight, in order to bring them to maturity. Civilized nations have long since ceased relying on indigenous plants; but, in order to transplant successfully from one country to another, it is necessary to know something of the climates of the two countries. Meteorologists are constantly extending their network of observing-stations, and are thus reducing the areas the climates of which are unknown. When the agricultural physicists shall have determined the climatic constants of all our useful plants, it will be possible to foretell the successful, or the probability of successful, cultivation of any of these plants, when we know the latitude, longitude, and altitude above sea-level, of the place of planting.

We need better systems of estimating the condition of plant-growth during the period from sprouting to ripening (or harvesting). Reliable estimates of this kind would be a valuable criterion for market prices of produce. The usefulness of storm predictions, frost warnings, and cold-wave predictions, is so well established that we only take space to say that the non-fulfilment of the latter causes great loss to farmers who slaughter their own animals.

2. COMMERCE.—In dictating what can or shall not be grown in any particular country, climate controls indirectly the nature of the articles carried from one country to another. Merchants will not send articles intended for a hot climate to a cold climate, and *vice versa*. Still, a great many sailing-vessels are employed in trade, and their navigators pay the strictest attention to the laws of winds which have been discovered to hold good for various quarters of the globe. This knowledge often makes a saving of months in a long voyage. Storm-predictions are of special importance to our coast shipping and to fishermen; but the recent inquiries instituted by the German Government show that storms must be predicted considerably in advance to render such forecasting of real use. In shipping perishable produce it is of great importance to know whether damaging weather is likely to occur during the transit, frosts being the principal danger which the shipper must guard against. A meteorological record extending

over a number of years is also necessary to show what precautions must be taken to prevent serious interruption of traffic; the record of snow-storms being most desirable along railroad routes, and of ice periods and low water on the water-ways.

3. MANUFACTURES AND ARTS.—The unremitting labor necessary for the successful operation of manufactories is best obtained in the colder climates. The arts of a nation are, many of them, regulated by the nature of the climate. Water-power, while it is dependent on the slope of the land and other local peculiarities for the head of water, is principally influenced by the amount and regularity of rainfall, conditions which are favorable to alternate floods and draughts being especially unfavorable to use of water-power. Many articles will not stand the removal from one country to another having a different climate, an instance being the cracking of picture-frames brought to our country from the moister European lands; and such instruments as the zither, we are told, cannot be successfully brought to America. The manufacture of some articles requires an excess or deficiency of moisture, as in the case of some textile fabrics. The still unharnessed wind-power will play an important part in our manufactures when its force can be conveniently and economically transposed into electrical energy. Few persons are aware that a wind-wheel twenty feet in diameter, exposed at a moderate elevation above the ground, will furnish on the average one horse-power throughout the year, taking the average of our country east of the Rocky Mountains.

4. INSURANCE.—The increasing application of the principles of science to insurance adjustment must include meteorological data, when this begins to be carefully considered in this connection. Frequent remarks in the late insurance journals show that some meteorological events can no longer be excluded from the computation of risks, and even new fields are being entered upon. The recently established tornado insurance will doubtless be extended to include all storms; but the damages by floods are usually so dependent on local peculiarities, that such insurance can hardly be said to have a scientific basis. Unhealthy climates, and regions of scourges, which usually have marked climatic features, should not be included with healthier countries in any general rate of premium for life insurance. In marine insurance it is possible to take into account the probability of storms, not only for various seas and at different seasons of the year, but also for any sailing course between two ports on any particular sea. In fire insurance the high temperatures, and especially heated terms, and the amounts and frequency of rainfall, must be considered. Nor can we neglect the wind distribution as regards average velocity, and the relative frequency of high winds, and especially the sudden rise of winds which may start smouldering fires which are temporarily unattended.

5. MEDICINE.—Climate as applied to the treatment of disease has generally been studied in a desultory manner, although some general rules have been formulated which are accepted by the medical profession. In most cases, however, there is a wide difference of opinion as to what climatic factors are the most potent as a means of curing or preventing certain diseases; and we find physicians of the highest attainments recommending such extremes as to show that individual opinion in such matters has not yet given way to generally accepted results obtained by the careful study of statistics.

Each one of the climatic elements plays a special rôle in the combined effect produced on mankind, and it is these separate effects which must be studied more closely. We know that great daily ranges of temperature, or rapid changes from day to day, are to be avoided in certain diseases, and yet for our own country little data are accessible concerning the latter of these conditions. In recommending long journeys (for instance, from New England to California), how few physicians take into account the hygrometric and barometric conditions to be encountered *en route*! Observations on moisture, relative amounts of sunshine and cloudiness, ozone, and winds, are also necessary for determining the desirability of a place of residence for invalids.

6. MISCELLANEOUS ECONOMIC QUESTIONS.—Under this heading we may put a great many kinds of work in which meteorological data may be very useful. All subjects connected with drainage

require a knowledge of amount and frequency of rainfall. Railroad routes, especially where local traffic is to be the main source of income, are not laid out without a careful study of the climates of the countries through which they are to pass. Many engineering undertakings are directly affected by the climatic elements; as, for instance, the effects of winds on bridges. The first question to be answered in connection with the reclamation of our Western arid lands, which interests us so much at present, is, "What is the climate of the country to be reclaimed?" While our politicians are wrangling over the question of protection and free trade, few of them have recognized the bearing of climate on the question. While the use of the winds in aerial navigation is not of practical importance just at present, yet we have but to recall their universal use as power in the flat countries of Europe to show their possible application on our great plains, where a velocity is found almost equal to that on the seacoasts. Climate should be carefully considered in questions of emigration, for the immigrant will usually succeed best in a country having a climate similar to that which he left as an emigrant.

FRANK WALDO.

Cincinnati, O., May 23.

Temperature in Storms and High Areas.

I AM strongly of the opinion that Professor Davis has found a veritable "mare's nest" in his presentation of this subject in last week's *Science*. He is certainly nearly three years behind the times; for this whole matter has been thoroughly ventilated, and the palpable errors into which Dr. Hann has fallen have been already pointed out (see the *American Meteorological Journal*, October, 1887; March, 1888; July, 1889: and the *Scientific American Supplement*, June 15, 1889). The ordinary theory is, that in our storms the air, up to about ten thousand feet, is abnormally heated, and this causes an ascending current of moist, warm air, which has its moisture condensed through the cold of expansion; and that the latent heat set free serves to warm up the air, and thus to produce a rarefaction, which serves to accelerate the ascending current. This acceleration in the air-current causes a more rapid condensation, in turn a greater rarefaction, and so on till our most violent tornadoes are evolved. It is difficult to see why the latent heat of condensation does not exactly balance the cooling by expansion, but I leave that point for others to explain. Dr. Hann himself has made a most elaborate computation of this increased heat in a storm, in which he has shown that up to sixteen thousand feet the average temperature in a vertical direction may be about 50°, while in a high area it must be only 30° (see *Austrian Meteorological Journal*, 1874, p. 321). Professor Ferrel of our own country has written hundreds of pages in which the essential point is that there is an ascending current of moist heated air in our storms. In all his theories he has followed most closely the theoretical results deduced by Hann. All this, and I may say the pet theories of a dozen other authorities, are brushed away with a single stroke of the pen: they vanish as an ethereal essence into thin air, out of which we may say they were reasoned on exceedingly unsubstantial grounds.

These would seem most important conclusions, and should not be put forth without incontestable facts to establish them. Let us inquire into the nature of this evidence. 1st, Dr. Hann's observations are all made in the Alps, a region two thousand miles to the south-east of the average track of storms, also a region fifteen hundred miles from the nearly permanent winter high area in Siberia. Surely we are not to consider that it is possible to get an idea of the distribution of temperature in the centres of our storms and high areas under these conditions. The pressure undoubtedly rises and falls in the Alps; but the storms that cross there are in the nature of secondaries, and there is no opportunity to study real storms. No one ought to think that a study of temperature in the border of a storm and five hundred or a thousand miles from its centre, can give the central conditions. 2d, It would be a great mistake to study simply a fall or rise in pressure on a mountain as the passage of a storm or high area. One of the greatest falls in pressure on Pic du Midi, in France, accompanied a high area, and was caused by the intense cold. This

single fact is sufficient to disprove all these finely spun theories of Dr. Hann. 3d, The evidence of our own storms is absolutely conclusive on this point, and I kindly turn Professor Davis's attention to this. Fortunately we have a mountain in this country which lifts its head sixty-three hundred feet directly into the centre of more than half our storms and a great number of our high areas. We cannot ask for better evidence than Mount Washington furnishes us with so lavish a hand. Observations are given us for eighteen years from this most remarkable vantage-ground, and these give no uncertain sound on this question. When a storm approaches within five hundred or six hundred miles of this almost perpendicular and isolated height, the temperature begins to rise, and, when the centre passes, the average temperature of its central core is more than ten degrees higher than that of the air five hundred miles in advance. As the storm passes off, the temperature rapidly falls, and is fifteen degrees lower five hundred miles after it than at the centre. When a high area passes, the temperature begins falling, and the diminution and subsequent rise follow each other in almost exactly the manner and to the degree of the reverse operation in a storm.

The evidence on this point is absolutely conclusive; and, since the seeming contradiction in the Alps can be easily explained, we see that there is no need of changing theories on this account. It will be understood that the ordinary theories of storm-generation are none the less utterly worthless, even though this supposed proof of their worthlessness is itself worthless. It is highly probable that Dr. Hann has been misinterpreted in this presentation of his views, and no one will be more shocked than he at this outcome. Dr. Hann found in a certain October storm the average temperature nearly eight degrees below the thirty years' normal for the height in consideration, and in this storm the air was colder than in a high area nearly two months later. Surely this proves nothing whatsoever. The temperature in a vertical direction in a storm is not fixed, but may be ten degrees, or even more, lower than the average, and yet be many degrees above that of the surrounding region. That the temperature in an October storm was lower than in a November high area is not in any wise remarkable.

Professor Davis makes this remarkable statement: "The cyclonic air does not rise because it is warm, but, according to Dr. Hann, it is lifted in spite of becoming cool." I doubt if there is a sadder example of bowing down to authority than this. Where is the jack-screw by which this air is lifted? If the air becomes cooler than the surrounding air, does not its specific gravity at once cause it to descend? Is the law of gravity so easily overcome, and swept away by a single stroke? If there is some mighty force pressing down the air in our cold waves, and causing it to warm up the lower it gets, why does it not warm up clear down through? Where is this plane of demarcation, and change from a warm region to one just the opposite and bringing us the coldest period of the winter? There are millions who will thank Professor Davis if he will prove to them that they will not need to buy coal next winter, because, by a newly discovered law, our cold waves hereafter are going to be really warm waves, to use an Irishism.

Professor Davis says, further, "In this country, Hazen has drawn attention to the absence of indication of the 'neutral plane,' called for deductively; and for this and other reasons he has discarded pretty much all parts of the cyclonic theory, following Faye more closely than any other." It seems to me this is an exceedingly unfortunate allusion, if the intention is to support Dr. Hann in his views. The only reason why this so-called "neutral plane" was discarded was because in the centre of a storm it was found that the temperature continually rose, the higher up one went. It is easy to see that this condition is absolutely contrary to that presented by Dr. Hann. Faye has not been followed in this country, but his view that there was a downrush in a general storm has been denied. I am sure that no one will be as much pleased at this corroboration of his views by Professor Davis, and this proof of a downrush in a storm carrying in the cooler air of the upper regions, than M. Faye himself. If readers of *Science* are led to the belief that, after all, we know next to nothing of the real cause of a storm, and that the great and crying

necessity that is pressing upon the meteorologic world at present is reliable observation in the storm region, it will be a great advance.

H. A. HAZEN.

Washington, D.C., June 2.

The Winnebago County (Iowa) Meteorites.

A FRAGMENT of the 104-pound "meteorite" found in the northern part of Kossuth County has been examined by us, and we are perfectly well satisfied that it is not of meteoric origin at all. In outward appearance it is suspicious at first sight. The color is darker than that of the other pieces. There is no distinct crust, and no metal present. The gravity taken on a piece weighing about half a gram was 2.88, which is nearly a unit lower than that of the well-established specimens. Under the microscope the crushed mineral shows by reflected light a mass of colorless, transparent particles mingled with dark green particles resembling pyroxene. The analyses given below, together with the appearance of the chip furnished us, strongly suggest diorite or some closely allied rock.

Silica.....	71.68
Oxides of iron and aluminum	14.89
Lime.....	6.80
Magnesia.....	—
Soda.....	5.55
Water.....	1.68
Total.....	100.00

Some circumstances connected with the finding of this piece have made us slightly suspicious from the first, and such examination as we have given thus far seems to be conclusive.

JOSEPH TORREY, JR.
ERWIN H. BARBOUR,

Iowa College, Grinnell, Io., May 24.

BOOK-REVIEWS.

The Village Community, with Special Reference to the Origin and Form of its Survivals in Britain. By GEORGE LAURENCE GOMME. New York, Scribner & Welford. 12°. \$1.25.

THE special object of this work, which is the latest volume of the Contemporary Science Series, is to present the author's theory as to the origin of British village communities. He rejects the view most commonly held, that they are exclusively Aryan institutions, and particularly repudiates the theory of their Roman origin, and endeavors to show that they date back to prehistoric times, when the British Isles were peopled by Iberians. He admits, of course, that there is no direct evidence to support this view, but attempts to prove it by reference to India, where village communities are known to have existed before the advent of the Aryan conquerors. He adduces a number of facts relating to the British communities in historic times, and shows that they have parallels more or less close in those of India; and from these facts he draws the conclusion that the origin of the two systems must have been similar. "Over and over again," he says, "the certain evidence of these race distinctions which is forthcoming from the unamalgamated elements in Indian villages finds a parallel among the existing archaeological and traditional facts of English villages; and my contention is that the parallel must be true all along the line—must therefore tell us of the old race origins of the English village life" (p. 115). The evidence he adduces in support of this view is by no means sufficient to make it an established theory, though it does show that such an origin of the British communities is possible. The subject, as every one who has even a slight knowledge of it knows, is a difficult one, and it will probably be some time before a general agreement is reached in regard to it. But meanwhile it is necessary to consider the question in all its aspects, and for this reason students of the subject will take a good deal of interest in reading Mr. Gomme's work. He marshals a great array of facts in support of his theory, though he acknowledges that some of them admit of other interpretations than those he gives; and both the facts and his reasonings on them will be useful to other investigators.

Electrical Influence Machines. By JOHN GRAY. London, Whitaker; New York, Van Nostrand. 12°. \$1.75.

IN this volume Professor Gray, who is an associate of the Institute of Electrical Engineers of London, gives a very full account of the historical development and modern forms of electrical influence-machines, together with instructions for making them. The branch of electrical science covered by this treatise has been apparently somewhat neglected of late years; and for that reason alone the volume would be welcome, aside from the fact that it contains in compact form all that is really useful and interesting about influence-machines. It shows, also, that the neglect of investigators in this direction has been more apparent than real, for great progress has been made, but the greater progress made in the development and commercial utilization of dynamical electricity has made it seem that the static form had almost been forgotten. But, as the author shows, the influence-machine has an important field of its own, and, in some of its latest and most improved forms, is a simple and convenient generator of high-tension electricity, nearly as reliable as the induction-coil, and less expensive.

The work is divided into three parts. The first is devoted to a general sketch of the phenomena and leading principles of static electricity, a chapter each being given to experimental data, to a working hypothesis of the electrical field, and to electrometers. This part is sufficiently complete to serve instead of a text-book for beginners, and will enable those with little mathematical

knowledge to understand the nature of electrical quantities. The second part is devoted to the historical development of the machines, and also contains descriptions of modern ones, such as Varley and Töpler's, Holtz's, Wimshurst's, Sir W. Thomson's, Maxwell's, and "addition" machines such as Bertsch's and Carré's. The third part contains all the information needed by instrument-makers and amateurs to guide them in making the influence-machines most commonly used. The book is illustrated by two hundred and twenty-eight engravings, and has a very complete index.

AMONG THE PUBLISHERS.

It is proposed to publish the results of the research of the special students in the Department of American History at the University of Pennsylvania in a regular series of pamphlets.

—D. C. Heath & Co. will publish June 10, "A Compendious French Grammar," by A. H. Edgren, professor of modern languages in the University of Nebraska.

—The *New York Home Journal* just now is of especial interest to people who contemplate spending the summer, or part of it, in the country. It is issuing several editions of a "Summer Resort Guide," of which it has for years made a feature.

—The *Political Science Quarterly* for June opens with a defence of national sovereignty in the United States, by John A. Jameson, against the theories of the "analytical jurists;" E. I. Renick of the Treasury Department discusses the relations of the

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INDUSTRIAL NOTES.

New Portable Photometer.

To meet the demand created by the rapid adoption of the electric light for town and city lighting, and consequent necessity of making frequent tests for the purpose of conforming to certain standard conditions, Messrs. Queen & Co. have recently brought out a new form of Bunsen's photometer. This instrument is designed especially for street work, and will be found invaluable to municipal and government inspectors and experts having occasion to make candle-power tests of arc and incandescent lamps. The photometer is $5\frac{1}{2}$ inches square in cross-sections, and 38 inches in length. The lantern, as shown in the cut, slips into one end of the box, where it is firmly held. A small adjustable holder carries the standard light, which may be either one or two standard candles. This adjustment regulates the height at which the flame stands, and also its distance from the screen. By making this latter distance exactly one foot, computation is greatly facilitated. Distances are measured by a graduated bar which slides in grooves along the side of the box. To allow for the difference in vision between the right and the left eye, the instrument is made reversible; i.e., it may be turned completely over, so that the right eye observes the side of the disk before observed by the left, and *vice versa*. When not in use, the lantern-chimney slips out, and can be placed inside the lantern itself, after which the entire lantern-box may be pushed inside the photometer, and small slides made to cover the two ends and the sight hole of the

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CALENDAR OF SOCIETIES.

Biological Society, Washington.

May 31.—Theo. Gill, Characteristics of the Halosauroids or Lyopomes; C. Hart Merriam, Exhibition of Specimens of New Species of North American Mammals; J. N. Rose, Coulterella, a New Genus of Compositæ; Joseph F. James, Organisms in the St. Peter's Sandstone.

Engineers' Club, St. Louis.

May 21.—George A. Brown, The Function of the Government in a Plan for General Irrigation. In the discussion, Professor Nipher said that experiments extending over a long period of years had demonstrated that the apparent increase in rainfall in forests was due to the fact that the rain caught in the gauges was not affected by wind-currents. Improved forms of rain-gauges had shown that there was no actual difference between the amount of rain falling in forests and in open places.

Royal Meteorological Society, London.

May 21.—W. B. Tripp, Rainfall of the Globe. This was a comparative chronological account of some of the principal rainfall records. The earliest record is that of Paris, which commenced in 1689. The English records began in 1726. The rainfall observations in the southern hemisphere do not extend over a very long period. At Adelaide they were commenced in 1839, but they do not go back farther than 1866 for New Zealand. The greatest fall in any particular year at the stations given by the author was 160.9 inches at St. Bernard, in 1839; and the least, 3 inches, at San Diego, in California, in 1863. By combining the stations in the northern and southern hemispheres, the author finds that in recent times the years with the highest average rainfall were 1878, 1879, and 1883, and the years with the lowest average were 1854 and 1861. W. H. Dines, Mutual Influence of Two Pressure Plates upon Each Other, and Comparison of the Pressures upon Small and Large Plates; On the Variations of Pressure caused by the Wind blowing across the Mouth of a Tube. In these two papers the author gives the results of some experiments on wind-pressure which he has made mostly on a whirling-machine at Hersham, Surrey. From these experiments it seems probable that a decrease of pressure per square foot with an increase of size of plate may be taken as a general rule.

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ASSAYER.—Wanted position as above, has had three years' practical experience in a London firm of assayers to the Bank of England, Royal Mint, etc., etc. Thorough knowledge of bullion assaying, and of gold, silver and lead ores. I. FRED. JOHNSON, Northgate Brewery, Canterbury England.

AN EXPERIENCED Technical Chemist will be open to engagement this summer. Highest references. Address DIRECTOR, Office of SCIENCE.

PROF. WILLIAM FINDLAY, of the Philadelphia Institute of Physical Culture, is open to engagement in summer school to teach Free Movements, Wands, Clubs, Dumb-bells, Fencing and Sparring. Address 1,009 Arch St., Phila., Pa.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Wanted.—To exchange land and fresh-water mollusca (principally *Helices Achatinellae*, Clausiliae and Limnaeae,) for those not in my collection. Lists exchanged. Address E. H. White, Box 200, Astoria, Or.

To exchange for other books: Meek's Invertebrate Paleontology, Cope's Cretaceous Vertebrata, Leidy's Extinct Vertebrate Fauna, Lesquereux Cretaceous Flora. All being volumes of the Hayden Final Reports. Address, giving lists, T. N. Glover, Suffern, N. Y.

Meteorites.—Mr. George F. Kunz, 11 to 15 Union Square, New York, or Hoboken, N. J., will buy or give in exchange for whole or parts of meteorites. Whole ones, undescribed ones, and entire falls especially desired.

Wanted.—To furnish roots of *Dodecatheon Meadia*, *Sarracenia purpurea*, and other wild flowers, native of Southern Wisconsin, in quantities. D. E. Willard, Curator of Museum, Albion Academy, Albion, Wis.

For Exchange.—Fourteen volumes Encyclopedia Britannica (Stoddard's ninth edition), bound in leather—part in original wrappers, all as new—can arrange to furnish volumes required to complete set, and six volumes "American Naturalist" in numbers. Want small screw-cutting foot lathe and testing galvanometer and rheostat. For particulars address A. B. Campbell, McKean Co., Bradford, Pa.